

LECTURE MATERIAL

IT 662 Enterprise Resource Planning

Semester 2, 2003-04

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IIT Bombay

Students registered

PhD and MTech of IDP IE & OR , MTech of KreSIT and MTech of CSE

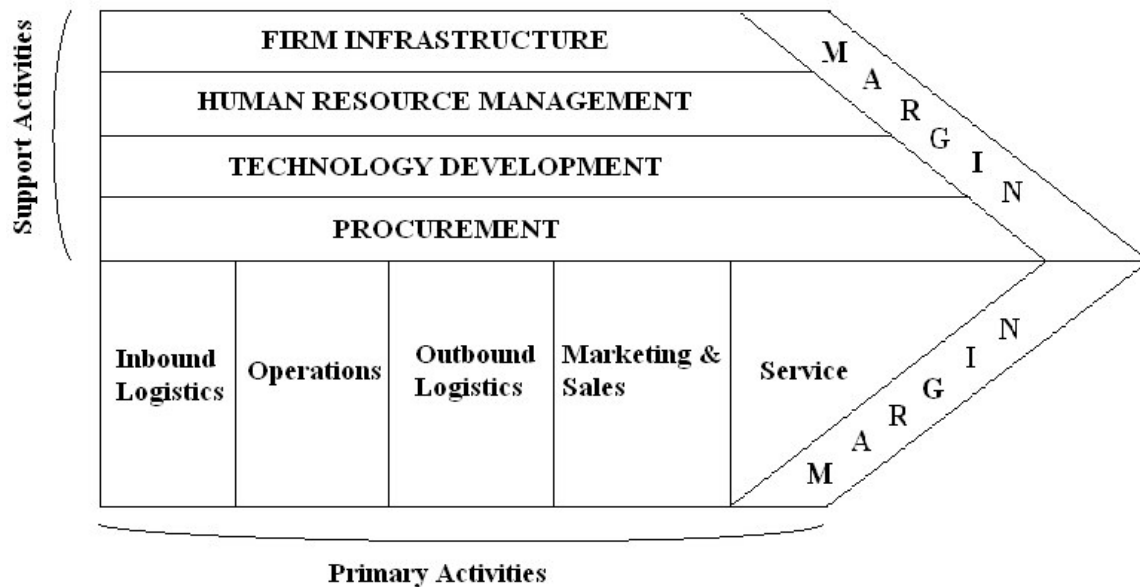
Course Focus:

1. **Perspectives** of Enterprise Management and Global Competition: Innovations and Excellence in enterprise Management,
2. **Perspectives** of Value Management, Engineering Economic Analysis, Decision Theory, Advances in Manufacturing Management, Assurance Technology, Supply Chain Management and Logistics, Technology management and Business Process Reengineering
3. **The emergence and need** for ERP concept: ERP systems for manufacturing service based organizations; Architecture of typical ERP systems.
4. **Selection** of ERP Systems: Critical Factors guiding selection;
5. **Strategies** for successful implementation: impediments and initiatives to achieving success, critical success and failure factors, integrating ERP into organizational culture, false proofing and Confidence building.
6. **Post ERP experiences** of Organizations.
7. **Issues** Related to Software Project Management, Software Quality Management and Six Sigma Management.
8. **Issues** related to Inter-operability Enterprise Management, Enterprise Application Integration, Embedded Systems, Cyber-mediary and Web Services.
9. **ERP-relationship with** OR models, Simulation Analysis, Data warehousing, Data mining, CRM, EPM, PRM, Balanced Score Card, Benchmarking, DEA, and Knowledge Management Systems.
10. **Visits** to Manufacturing Industries; Visits to Software companies for lecture cum demo of well known systems like Peoplesoft, SAP, MFG, Pro and BaaN.
11. **Experience with CIMPSIP** (the Enterprise Solution System Developed at IIT Bombay)
12. Individual and Group Projects.

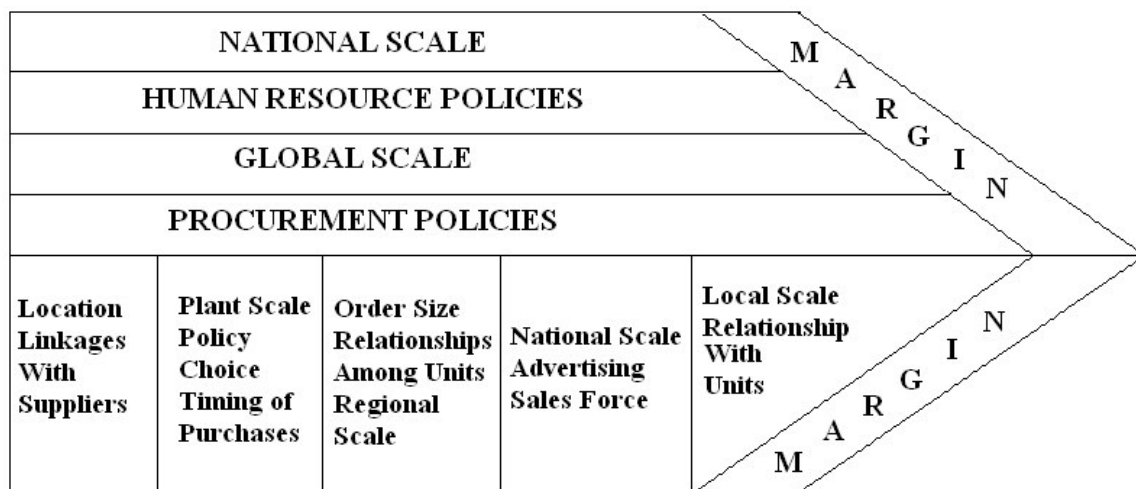
TOPICS COVERED BY EACH LECTURE

LECTURE 1 Date : 2.1.2004

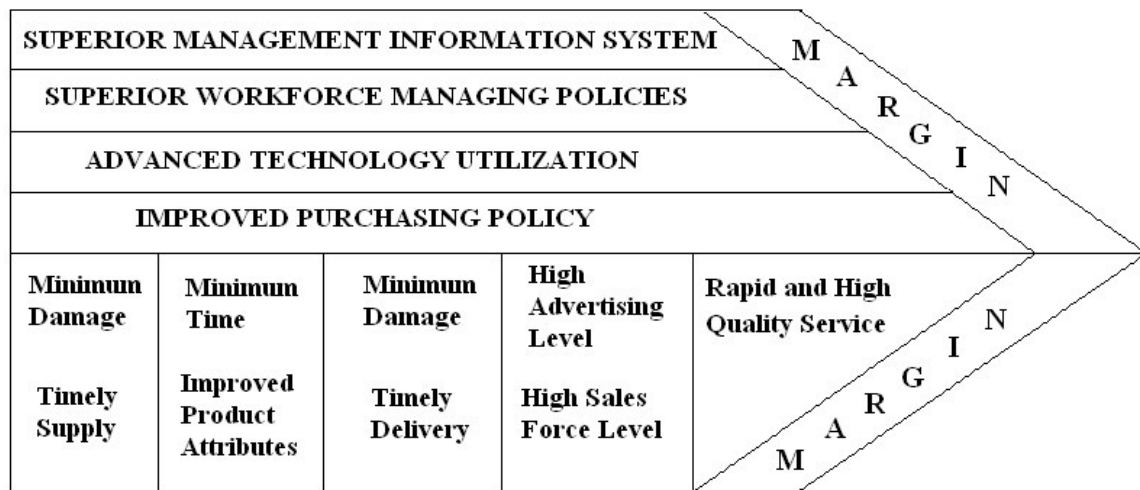
The Generic Value Chain



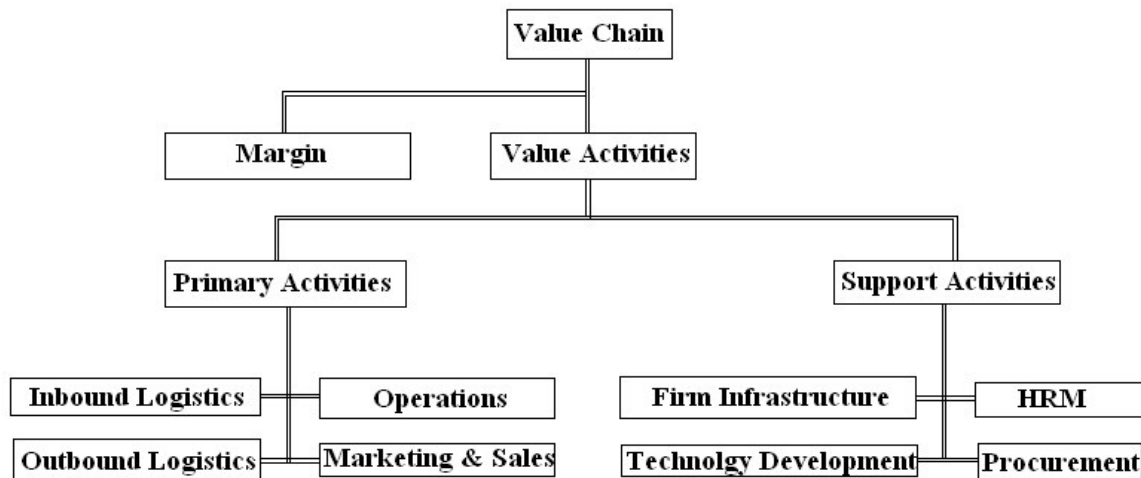
COST DRIVERS

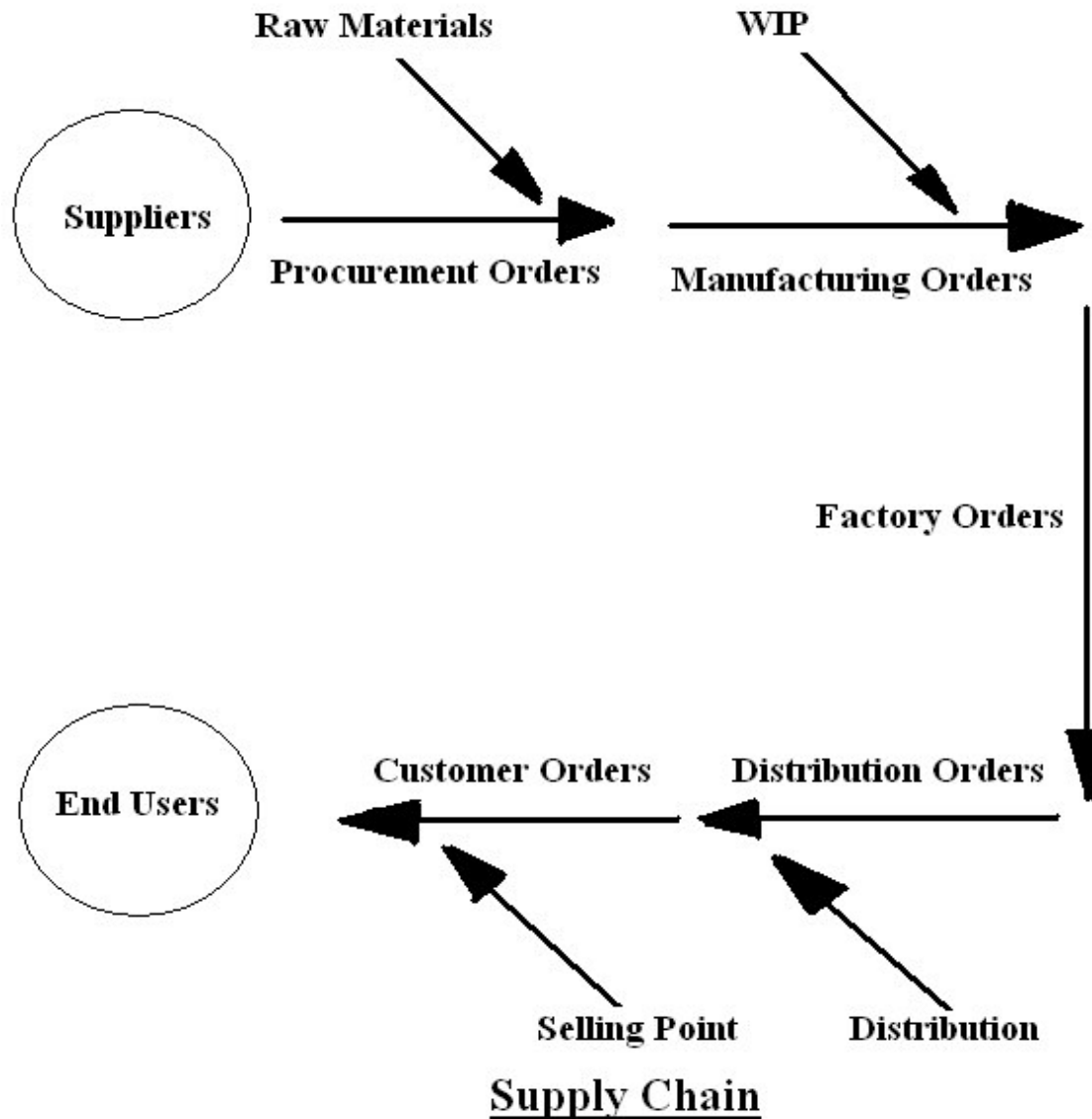


Sources of Differentiation



Value Chain





Cost Reduction

- High Capacity Utilization
- High Productivity
 - Reducing Fixed Assets
- Short Throughput Time
- Higher Flexibility
 - Reducing Current Assets

Options Are:

1. Strategic-
Through Innovation –Product Process
2. Operational-
Through Realizing Greater Flexibility

LECTURE 2 Date:06-01-2004

What is Management ?

Evolution of Management Era

Classical Era(1800)

- Use People Effectively

Human Relations Era(1924)

- Treat People Well

Human Resources Era(1955)

- Use People Well

Organizational Empowerment Era (1970)

- Develop and Entrust
- TQM era/IT era

Basic principles of Scientific Management (F.W.Taylor-(1856-1915)):

- Find the one best way.
- Match the people to the tasks.
- Supervise, Reward and Punish.
- Use staff to plan and Control.

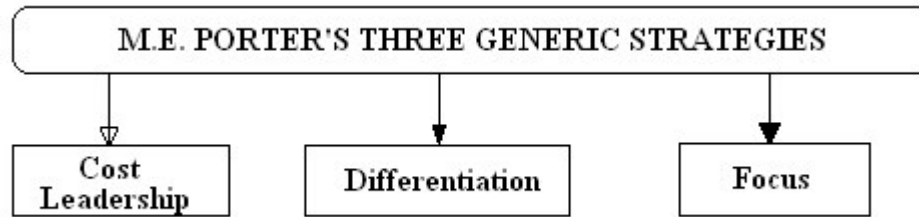
Modern view of Broader Managerial Function: (Peter Drucker)

- Managing Business
 - Entrepreneurial, Innovative, adaptive.
- Managing Managers
 - Management by Objective.
- Managing workers and work
 - Vital resources ,More control over the job

Three C's of Business:

- Customer
- Competition
- Change

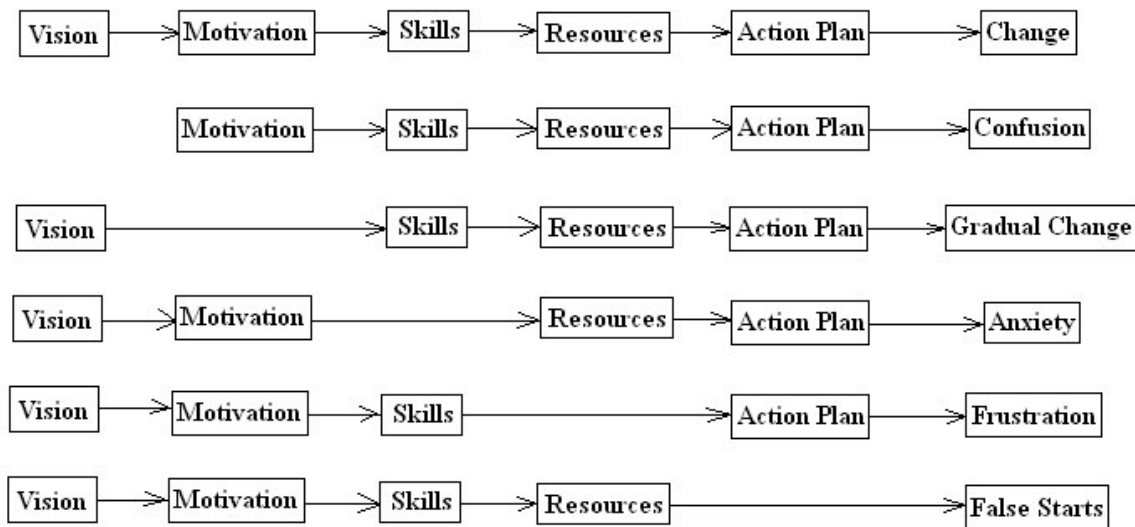
Competitive Strategy:



In search of Excellence:

- Quality
- Productivity
- Cost
- Customer responsiveness
- Delivery
- Customer Satisfaction
- Improved Business results.

Managing Complex Change



Global Competition is characterized by:(Uday Karmarkar)

- MNC firms in many sectors.
- Increased volume of trade
- Emergence of Worldwide standard
- Customer with high Expectations
- Opening of Markets
- Industry structure change: Alliance
- Significant increases in living Standard

What has changed?

- Reduced relative costs of transportation.
- Increased global availability of information.
- Reduction of transaction cost of trade.
- Technology diffusion.
- Political relations lead to business relations(US in Philippines, Japan, Korea etc.)
- International Culture in customer goods.
- Reductions in tariffs, open markets
- Privatization: Political Changes in Socialist World
- Internationalization of capital markets and convertibility of currency.

Industry and Company Strategies:

- Must compete in world markets.
- Must follow world wide trends in product design, customer tastes and industrial practice.
- Must adopt best practice in industry.
- Must select, product, process and markets to exploit advantages.

Competitive Strategies for Excellence:

- Business Strategy
- Marketing Strategy
- Design Strategy
- Manufacturing Strategy
- Service Strategy
- Financial Control Strategy
- Organizational Development Strategy
- Information System and Technology Strategy

Implication of Manufacturing Strategy:

- Supply Chain Management and Positioning.
- Sourcing, make-buy and purchasing.
- Analysis of manufacturing networks
- Multi-plant logistics and distribution
- Information flows in supply chain
- Product and process selection
- Incentive and performance measure
- Best manufacturing management practices

SUPPLY CHAIN MANAGEMENT

What is a Supply Chain ?

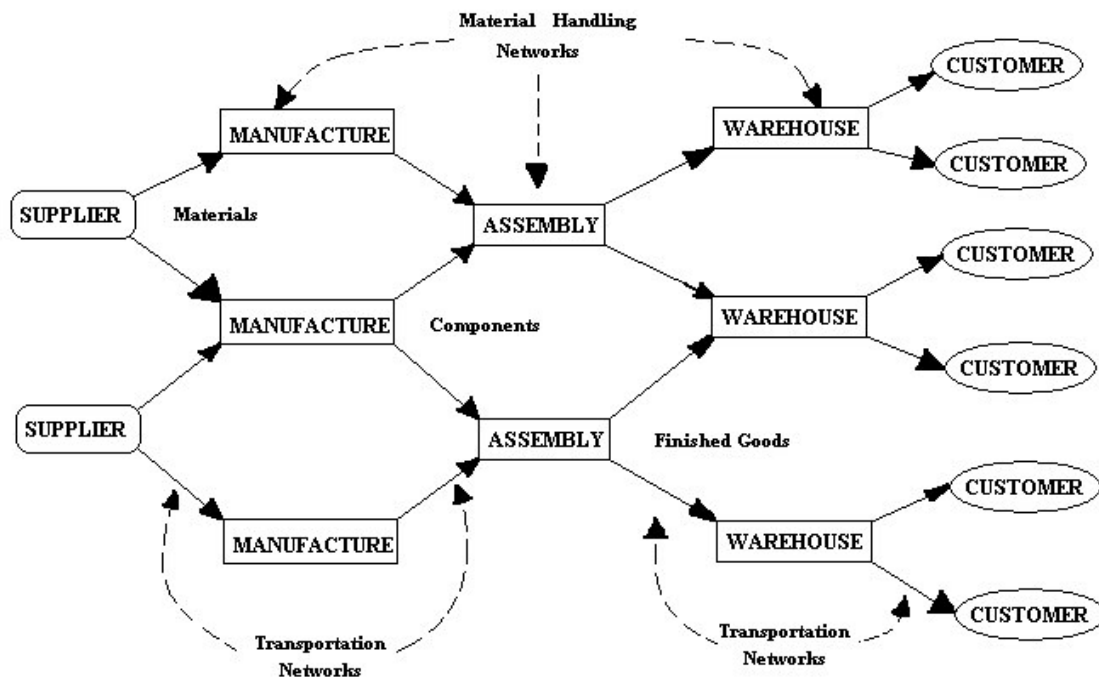
- A network of suppliers, manufacturing, assembly, distribution and logistics facilities.
- To perform the functions of
 1. procurements of materials
 2. transformation into intermediate and finished products
 3. distribution of products and customer

What is Supply Chain Management?

- Effective integration of various functional entities
- Meet the objective of organization

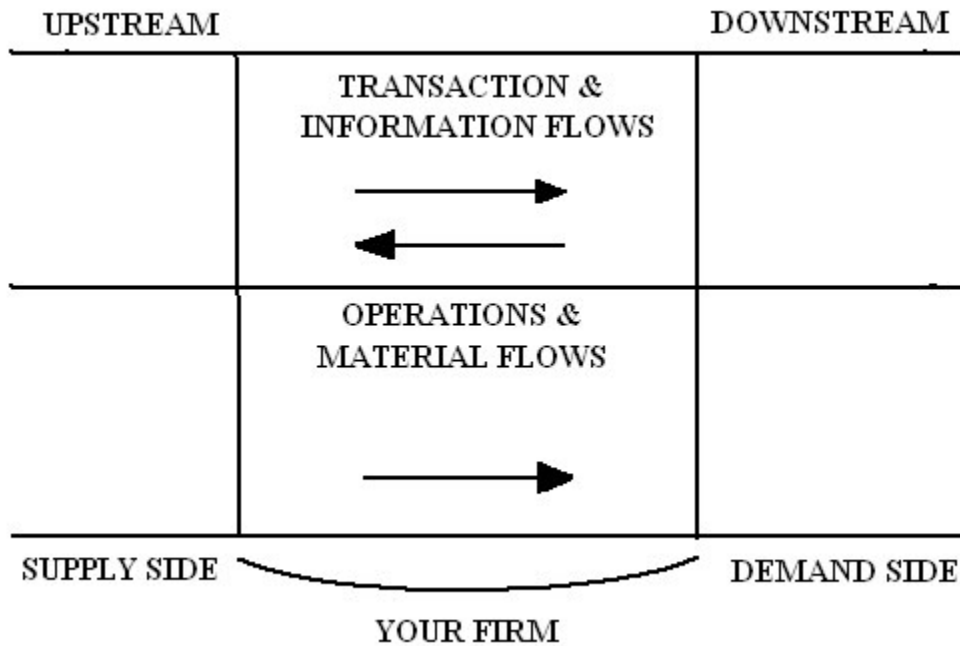


A Simple Supply Chain



A Typical Supply Chain

A SCHEMATIC



SCM is

- A set of approaches to efficiently integrate
suppliers
manufacturing
warehouse
stores
- To produce and distribute the goods
right quantities
right location
right time
- To meet the goals of
minimizing system wide cost
satisfying service level requirements

SCM is also

- Planning, Designing and controlling the flow of
Information
Material
Money
- To meet the customer requirements
- In an efficient manner .

Supply Chain Business Process

1. Customer Relationship Management Process.(SIEBEL-CRM Software)
2. Customer Service Management Process
3. Demand Management Process
4. Customer Order Fulfillment Process
5. Procurement Process
6. Product Development and Commercialization
7. Return Process

Managerial Issues of Major Concern:

1. Demand Forecasting and Planning
2. Inventory Management
3. Transportation
4. Warehousing and material Handling
5. Physical Distribution Strategies
6. Supplier Evaluation and Selection
7. Logistics Cost
8. Managing Demand variability in Supply Chain
9. Managing Relationships in Supply Chain
10. Performance Measures
11. Customer Service

Design Logistics and Integration of Supply Chain:

A)Network Design Problem

- I. The Arrangement Stage
- II.The deployment Stage
- III.The Flow Stage
- IV.The Operations Stage

B)Logistics Decisions

- I. Supplier Stage
- II.Plant Stage
 - Transformation Network
 - Location/Allocation Decisions
 - Inventory
 - Production Distribution Coordination
- I. Distribution Stage
 - Distribution Network
 - Location/Allocation Decisions
 - Inventory

C)Integration

- Customer Service
- Demand Forecasting/Planning
- Inventory Management
- Logistics Communication

- Material Handling
- Order Processing
- Packaging
- Plant and Warehouse Site Selection
- Reverse Logistics
- Traffic and Transportation
- Warehousing and Storage

- **Supply chain**
Every stage in the processing chain from raw materials to placement with the buyer (and sometimes beyond)

- **Supply chain management covers the issues relating to**
 - Positioning
 - Product design
 - Selection/sourcing
 - Negotiating
 - Forecasting/scheduling
 - Logistics
 - Provisioning
 - Organization
 - Quality
 - Customer service
 - After-sale support

Traditional Approach (Uday Karmarkar)

PROFIT is

DEMAND (Price-Direct Costs) minus

EQUIPMENT (costs) minus

OTHERFIXED costs.

- Cost centre view of manufacturing functions
- Focus on labour, materials and equipment costs
- Typical approaches
 - Minimisation of average cost per unit produced
 - Maximise equipment utilization, throughput
 - Minimize labour and material costs, material losses
- Results
 - High (average utilization, WIP, lead times), long run lengths.
 - Low (excess capacity, flexibility, quality emphasis, standards)

Competitive Impact

PROFIT is

DEMAND (Price-Direct Costs) minus

EQUIPMENT (costs) minus

OTHERFIXED costs.

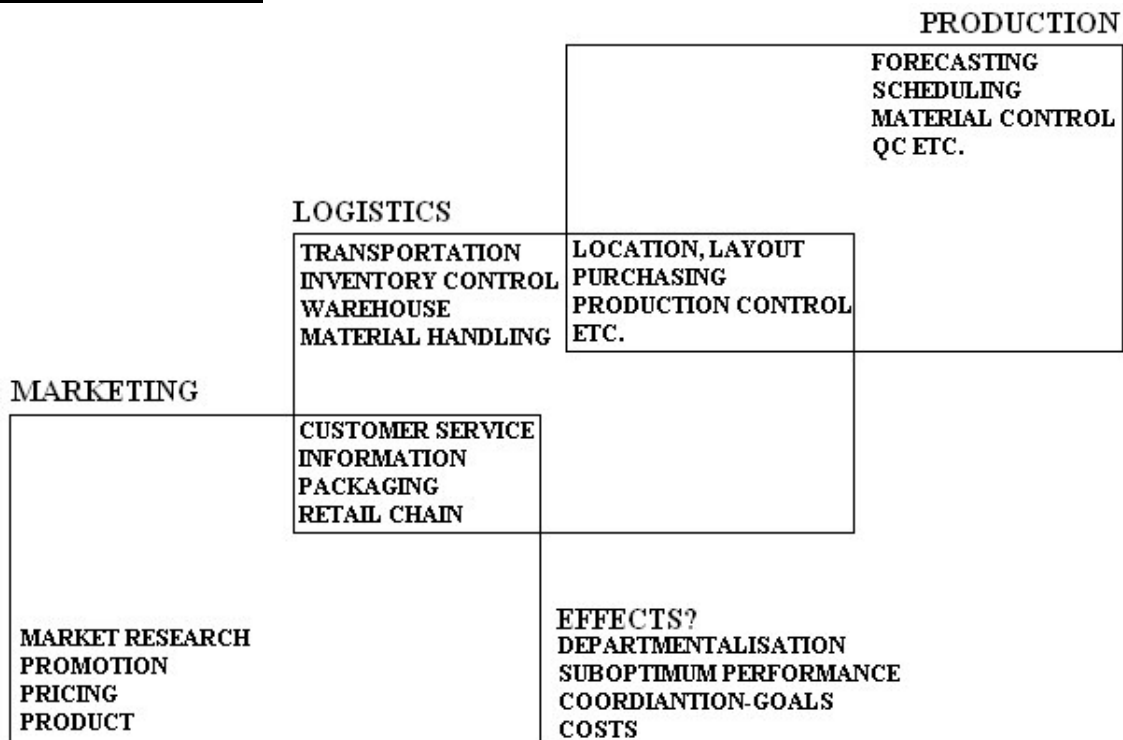
Awareness of market effects, revenue impact

Relationships of markets share to quality, flexibility, responsiveness

Indirect effects (warranties, service, spares, rework)

Dynamic factors (WIP, lead times, safety stocks, overtime)

THE INTERFACE?



Add to this the interactions of

- Finance/accounts department
- HRD
- Government
- Consumer group etc.

Complex ?

Benefits of Effective SCM:

1. Increases Revenue and Improves Profitability
2. Reduces Operating and Administrative Costs
3. Faster Inventory turns throughout the supply chain, reduces inventory carrying costs and overall product cost base
4. Improves Customer Responsiveness

5. Increases Product Availability and Market Share
6. Enhances Customer Satisfaction
7. Shorter Engineering-to- Production cycle time
8. Improves Customer Service and Customer Relationships
9. Improves Vendor Management
10. Makes the Business more competitive

Constraints in Achieving Supply Chain Objectives

- Demand Constraints
- Product Constraints
- Technological Constraints
- Industry Constraints
- Government Constraints
- Natural Constraints

WHAT ARE THE APPROPRIATE NEW INNOVATIONS?

LECTURE 4 : Date 9.1.04

CORE COMPETENCE (B.S Murthy)

Skill +competition =Competence
Competition +strategy= Core Competence

Core competence

A set of skills linked by

Organisational learning----meta skills

To develop unique high level capability.

Core competence enables a business to create sustainable competitive advantage.

What is core competence & what is not

Competence is a gateway to future markets and prosperity

- Uniqueness, creates *Competitor differentiation*
- An *Integration* of skills
- Customer *Value* builder
- Competitive *Advantage* generator
- *Extendibility* of a product / service family
- Collective *Human Resource*
- Not *Assets & Infrastructure*
- Not the degree of *vertical Integration*
- Not the existing *Installed Base*

LEVERAGING RESOURCES

Conserving Resources

- Recycling
- Co-opting
- Protecting

Concentrating Resources

- Converging
- Targeting

Complementing Resources

- Blending
- Balancing

Accumulating Resources

- Mining
- Borrowing

Recovering Resources

- Expediting

CORE COMPETENCE

Collective Human Resources

- Are unique –proprietary group of skill
- Relate to Technical and business skill

Competition

- Are different from competitors
- Are relative to competitors rather than absolute
- Relate to long term competitive advantage

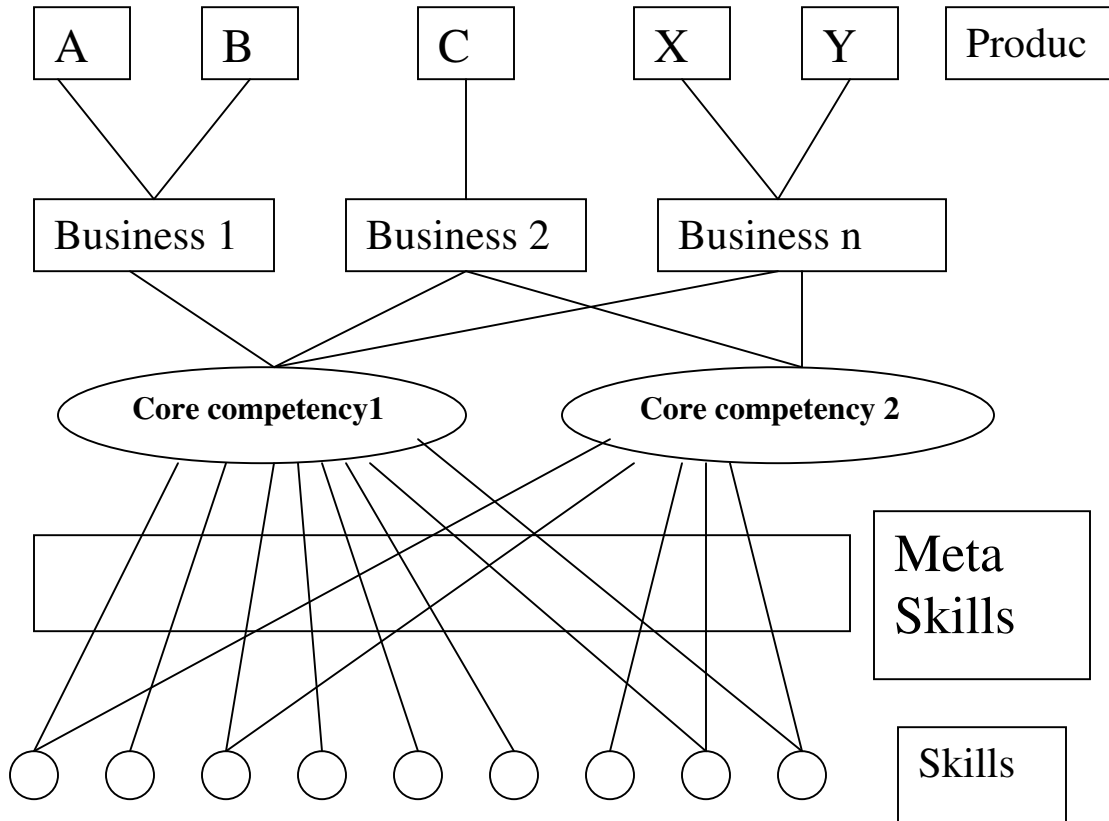
Customer Value

- Relate to market opportunities
- Can be developed to address to new market
- Usually address more than one business / product area

Example of Core Competence

Company	Customer Value	Core Competence
Sony	Pocket ability	Miniaturization
Motorola	Untethered Communication	Wireless
Federal Express	Delivery on Time	Logistics
Wal Mart	Choice, Cost & Availability	Logistics

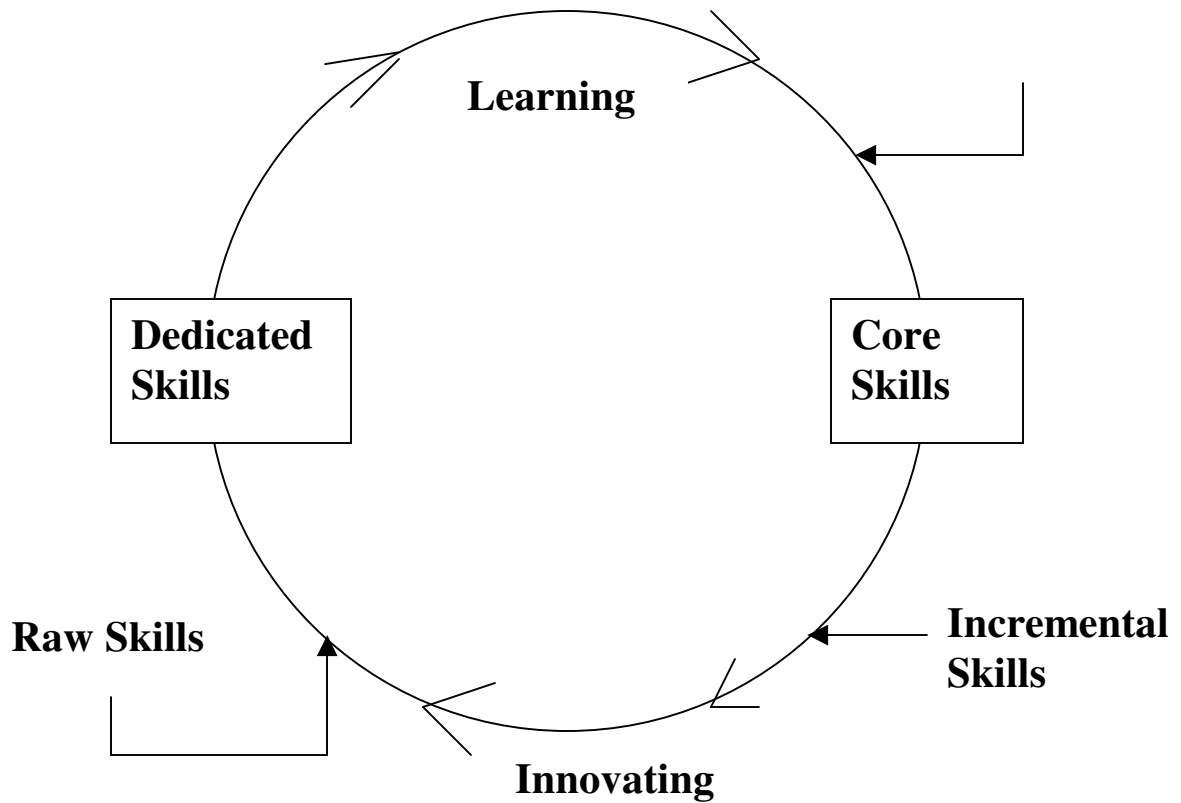
Core Competence & Metaskills



Physics EE CS ME Tex Mgmt Chem Ind E

Core Competence Development





Development

- **Learning**
 - **Study**
 - **Discussion**
 - **Practical**
- **Innovative**
- **Skill Categorizing**
- **Embedding**

McKinsey's 7 S's of Management

- Super ordinate Goal (vision)
- Strategy*
- Structure
- Staffing*
- Systems*
- Skills*
- Style

*core competence influenced

LECTURE 5- Date: 13.1.04

Decision Making Selection of

- One action or sequence of actions
- From a number of alternatives

Best Decision

- Decision that optimizes the objective /criteria upon the Decision Depends
 - Maximize
 - Minimize
 - Maxi max/ Min max
 - Max min

Decision Problems are Based On

- Degree of uncertainty of outcome
 - certainty (Deterministic)
 - Risk(probabilistic)
 - Uncertainty
- Degree of Interdependence Among Decisions
 - Single period
 - Multiple period
 - Single decision
 - Sequential Decision

Certainty

- When we know for sure what the out come of each decision alternative will be

Risk

- When a decision alternative can result in
 - More than one possible outcome
 - We know the relative chance of each outcome's occurrence

Uncertainty

- When a decision alternative can result in
 - More than one possible outcome
 - We do not know the relative chance of each outcome's occurrence

When Do We Come Across?

- Two or more alternatives
- Possible outcomes identified
- Decision criterion identified

How They Are Different?

- Extent to which outcome of decision is known
- Extent to which the chance of outcome's occurrence known
- Procedure used in Computation / Evaluation

Example 1

- There are four alternatives

Alternative Location	Profit in Million Rs.
A	2
B	3
C	1
D	6

Objective: Maximum Profit.

Choice ?

Example 2

Growth Can be	Probability	Profit In 10 ⁶ Rs WRT to ALT			
		A	B	C	D
Low	0.2	0.3	0.2	0.4	0.6
Medium	0.3	0.8	0.6	0.5	0.7
High	0.5	0.9	1.1	0.6	0.8
Average Profit in 10 ⁶ Rs		0.75	0.77	0.53	0.73

Objective: Maximise Average Profit

Choice?

Example 3

Alter Native	Various conditions & Payoffs					Expected Payoff Rs.
	1	2	3	4	5	
	-40000	10000	60000	110000	160000	
	Associated Probability					
A	0.2	0.2	0.2	0.2	0.2	60000
B	0.1	0.2	0.4	0.2	0.1	60000
C	0.0	0.4	0.3	0.2	0.1	60000
D	0.1	0.2	0.3	0.3	0.1	65000

If option D is not available ?

$$\text{Variance } V = E(X^2) - \{ E(x) \}^2$$

$$\begin{aligned} \text{V of A} = & [\{ 0.2(-40000)^2 + 0.2(10000)^2 \\ & + 0.2(60000)^2 + 0.2(110000)^2 \\ & + 0.2(160000)^2 \} - (60000)^2] \end{aligned}$$

$$= 5000 \times 10^6$$

Similarly

$$\text{Vof B} = 3000 \times 10^6$$

$$\text{Vof C} = 2500 \times 10^6$$

$$\text{Vof D} = 3850 \times 10^6$$

Choice ?

Example 4

ALT	Possible Conditions		
	A	B	C
1	8	7	4
2	10	0	4
3	1	9	5
4	5	6	7

The Case of Uncertain Condition

Approach 1

- Nature would be worst
- Choose the best of the worst possible outcome
- Pessimistic view?
- Maxmin Strategy?

Steps

1. Find Minimum of each row
4,0,1,5
2. Find maximum of row minimum
5
3. Identify the corresponding "ALT"
ALT – 4

YOU ARE ASSURED OF AT LEAST '5'

Approach 2

- Nature at best
- Nothing can go wrong
- Optimistic view ?
- Maximax strategy ?

Steps

1. Find maximum of each row
8,10,9,7
2. Find maximum of Row Max
10
3. Identify the corresponding Alternative 'Alternative 2'
4. Consequences?

Notes:

If the Matrix is for Loss?

Approach 1 – Min.Max – conservative!

Approach 2 – Min.Min

Approach 3

- Avoid any regret about the decision
- Minmax regret rule?
- Savage rule?

Steps

1. For each condition, find the regret.

Given Pay off matrix

ALT	1	2	3
1	8	7	4
2	10	0	4
3	1	9	5
4	5	6	7

Obtain Regret matrix

1	2	2	3
2	0	9	3
3	9	0	2
4	5	3	0

2. From the regret matrix, find for each row maximum of regrets
3,9,9,5
3. Find MIN (max regrets) Min (3,9,9,5)
=3
4. Identify the Alternative
'ALTERNATIVE 1'

The regret cannot be larger than 3 under any condition!

Approach 4
Hurwitz Rule

Let i =Alternative, $i=1\dots\dots\dots n$
 j =Condition, $j=1\dots\dots\dots m$
 V_{ij} =Value of i for j

IF OPTIMISTIC

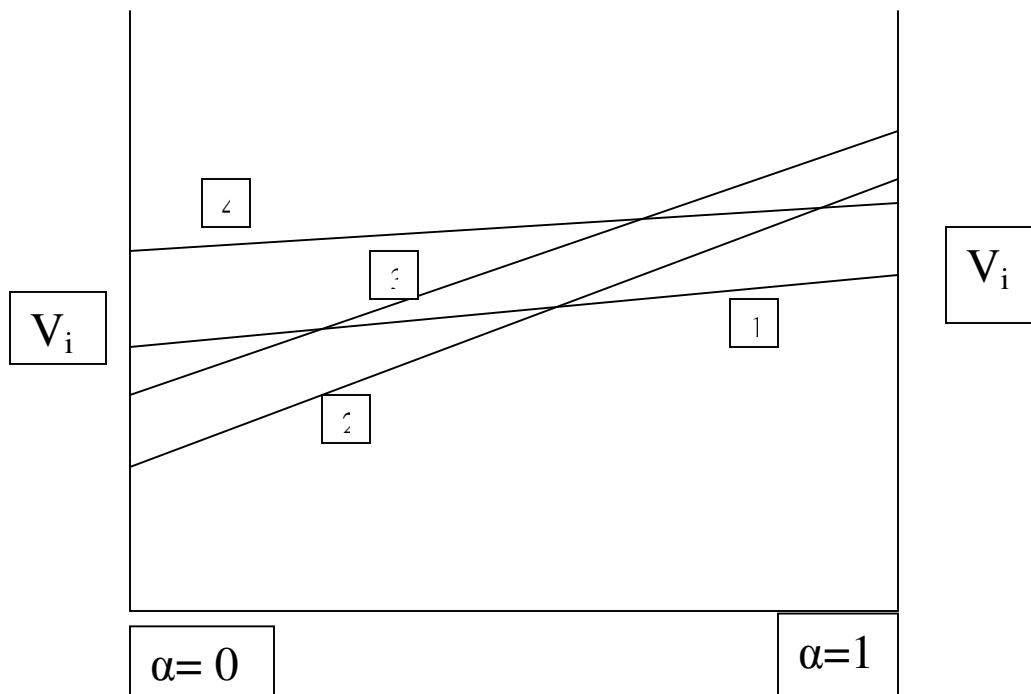
WE USE $\text{MAX}_i\{\text{MAX}_j V_{ij}\}$

IF PESSIMISTIC

WE USE $\text{MAX}_i\{\text{MIN}_j V_{ij}\}$

UNDER HURWITZ RULE

- FOR EACH ALTERNATIVE i
FIND $V_i = \alpha \text{MAX}_j V_{ij} + (1 - \alpha)\text{MIN}_j V_{ij}$
Where $0 \leq \alpha \leq 1$
- CONSIDERING ALL ALTERNATIVES,
FIND $\text{MAX}_i \{ V_i \}$, CALL IT V^*
- CHOOSE THE ALTERNATIVE RELATED TO V^*
- ALTERNATIVELY
PLOT V_i FOR $0 \leq \alpha \leq 1$, TO FIND THE BEST DECISION.



α DEFINES THE EXTENT OF HOW OPTIMISM AND PESSIMISM ARE MIXED

LECTURE 6- Date : 14.1.04

ENTERPRISE RESOURCE PLANING (ERP) SYSTEMS

ERP is the finest expression of the inseparability of infotech and business.

An enabling technology as well as an effective managerial tool.

Integrates all the process of the organisation

ERP is the planning of the 4 'm's of an enterprise's resources- man, money, material, machines-to their synergistic value

INFORMATION
SYSTEMS



INFORMATION
TECHNOLOGY



BUSINESS
PROCESSES

Information Technology in Business

- Electronic Data Processing (EDP)
 - Pay Roll
 - Materials
- Management Information System(MIS)
 - Materials Management
 - Accounts
 - Maintenance etc
- Decision Support Systems
 - All Functional Areas

Decision Support System For Manufacturing?

- Inventory
- Scheduling
- Capacity
- Productivity etc
- Material Requirement Planning (MRP 1)
- Manufacturing Resources Planning (MRP 2)
- ERP
- Supply Chain Management (SCM)
- Customer Relations Management (CRM)
- Knowledge Management System (KMS)
- Virtual Enterprises

ERP SYSTEMS

Focus is on Enterprise Wide Management

Concern is on Various Tasks/Functions In the Whole Enterprise Including

Understanding of Customer Needs

Evolving Business Plans

Managing Resources

Managing value Addition

Monitoring & Controlling of Task/ Operations

Fulfilling Customer Needs

Assess Cost Implications

All through effective integration

ERP is

New Philosophy For Enterprise Wide Management

Excellent Systems Framework For Managing Manufacturing And Other Systems

Encompass All Resources of Both Temporal And Spatial Types

Design/ Production / Assembly

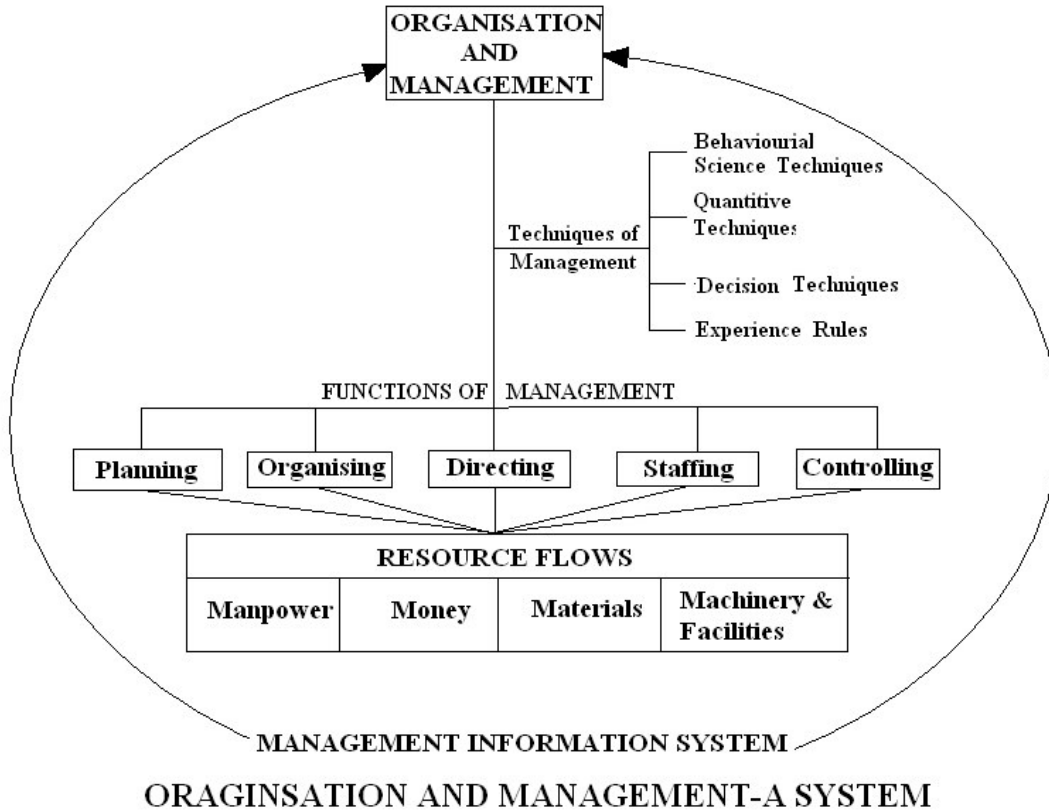
Quality/ Maintenance/ Technology

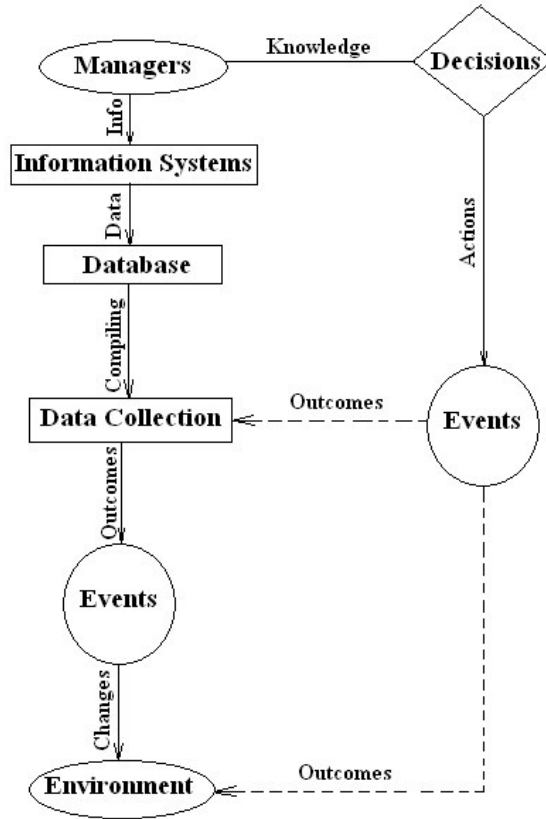
Finance/manpower

Storage/handling/transport

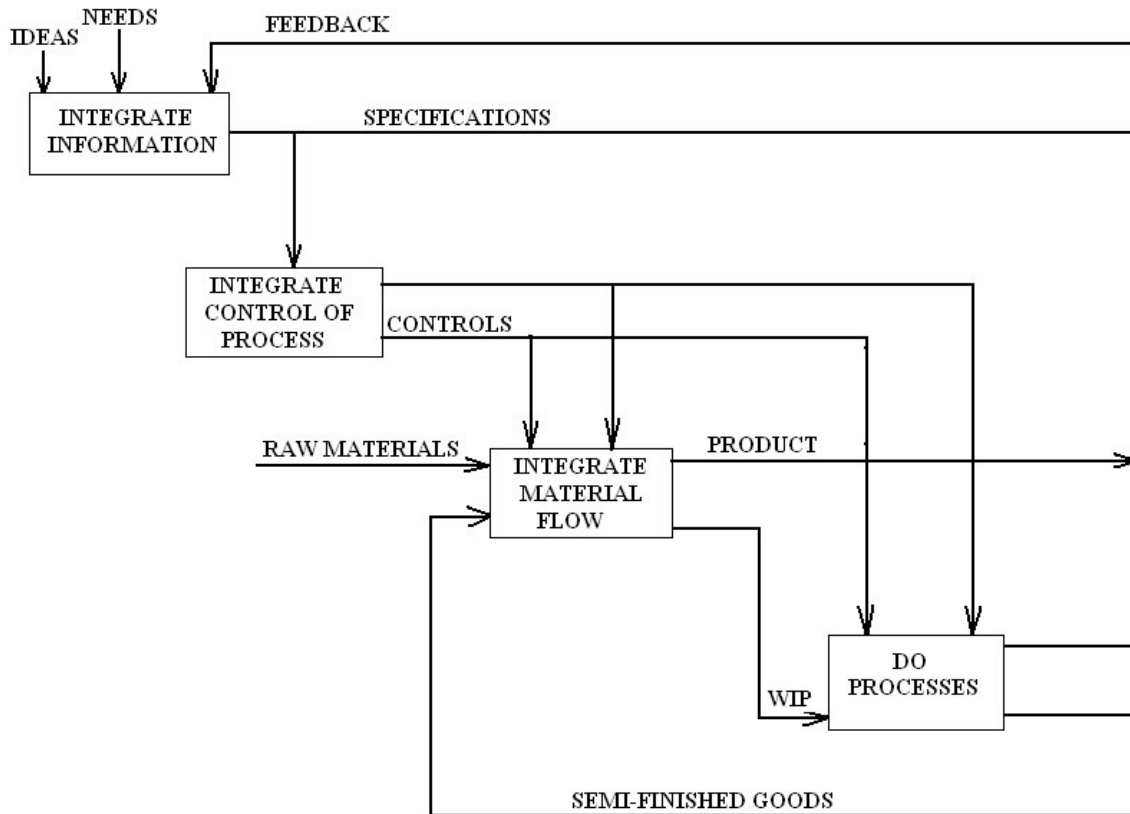
Marketing/service
Information/knowledge

***ERP IS EMBODIMENT OF FUNCTIONAL EXTENSIONS IN ENTERPRISE
MANAGEMENT AND INFORMATION TECHNOLOGY.***





Informational View of the Management Process



The Integration Role of Computer-Integrated Manufacturing(CIM)

Factory Management System:

Factory Management Involves Multitude of Functions and Responsibilities.

Facets of Factory Management

Facilities Management
 Manpower Management
 Production Management
 Materials Management
 Logistics Management
 Quality Engineering and Management
 Services and Supports Management
 Financial Management
 Space Management etc.

Need For Information Framework

Decisions are data dependent
 Data capturing and analysis – critical
 Managers are intuitive

- Logical/Subjective
- Intuitive Judgment should be:
- Rational/Consistent
- This needs data collection, analysis and inference as support.

**Lecture 7- Date 16.1.04 -
ISSUES RELATED TO ERP
Guest Lecture by Dr Raj Sharman, School of Management, SUNY, Buffalo, USA**

ERP General overview

Transaction processing systems

Examples
Payroll system
Order entry system

Enterprise resource planning systems

Set of integrated business applications
Purchased from a software vendor rather than developed internally

Enterprise resource planning systems

Usually includes modules to carry out common business functions, such as

Inventory control,
A/P,
A/R, and
MRP

ERP solution – the main strength

As a transaction is processed in one area, such as a receipt of an order, the impact of this transaction is immediately reflected in all other related areas such as accounting, production planning, purchasing, etc.

Enterprise resource planning systems

Distinguishing features from earlier TPS :
Modules are integrated, through common definitions and common database, and
Modules reflect a particular set of business processes

Features of an ERP solution

ERP modules have been designed to reflect a particular way of doing business
A particular set of business processes.

ERP modules have been designed to reflect a particular way of doing business – a particular set of business processes.

ERP systems are based on a value-chain view of business in which functional departments coordinate their work.

Cuts across traditional organizational boundaries like departments. Follows processes across departments

To implement an ERP system, implies that a company is committing to changing its business processes.

The company must adopt to the ERP, not vice-versa

Enterprise resource planning systems - Leading vendors

SAP (German),
BaaN,
Oracle and
Peoplesoft
J.D. edwards
IFS (International and financial systems)

Price- **Expensive , But...**

ERP - issues

ERP systems are complex. It is a challenging task to implement an ERP solution. It requires you to change your business practices.

Why are ERP systems very popular today?

What are the pros and cons of ERP systems?

ERP systems allow you to customize the ERP software.

Why not customize the ERP to fit your business practices?

What are the issues relating to customization of ERP software?

In Summary, ERP – what, why?

Enterprise wide Transaction processing system

Streamlined - based on business processes

Single logical database

Etc.

Alternate materials – programmed in for efficiency

Multi-national taxation, currency issues

Best practices , Etc.

No Struggle with Incompatible information systems and inconsistent operating systems

Led to excitement- Off-the-shelf, Solution to business integration

Lecture 8 Date 16.1.04
ISSUES RELATED TO ERP

Guest Lecture by Dr Raj Sharman, School of Management, SUNY, Buffalo, USA

Problems with ERP Solutions

Selection

Mainly Implementation

Over Budget

Time Management

Scope Creep

Unfulfilled promises

Managing Change

Horror- FoxMeyer Drug driven to bankruptcy.

Sued Anderson Consulting and SAP for 500 million each

Horror -Mobil Europe

Abandons ERP after spending hundreds of millions of dollars when its merger partner objected.

Horror -Dell Computers

Abandoned SAP project.

System would not fit its new, decentralized business model.

Horror -Applied Materials

Abandoned SAP

Found itself over-whelmed by the organizational changes involved.

Horror -Dow Chemicals

Abandoned SAP R/3 and restarted R/2

Spent 7 years implementing R/2

Changed directions after spending 1/5 billion dollars

Reason for debacles

a)Enormous technical challenges

Complex Systems

Installation Problems

b)Large investments of

Money

Time

Expertise

c)Business Problems

1)Companies fail to reconcile the technological imperatives of the enterprise system with the business needs of the enterprise itself.

2)ERP imposes its own logic on a company's Strategy , Organization and Culture

3)ERP pushes a company towards full integration even when a certain degree of business unit segregation may be in its best interests.

d)Competitive advantage lost.

